ACCELERATING SEED PRODUCTION APPLICABLE TO PROVISIONAL SEED ZONES IN THE GREAT BASIN

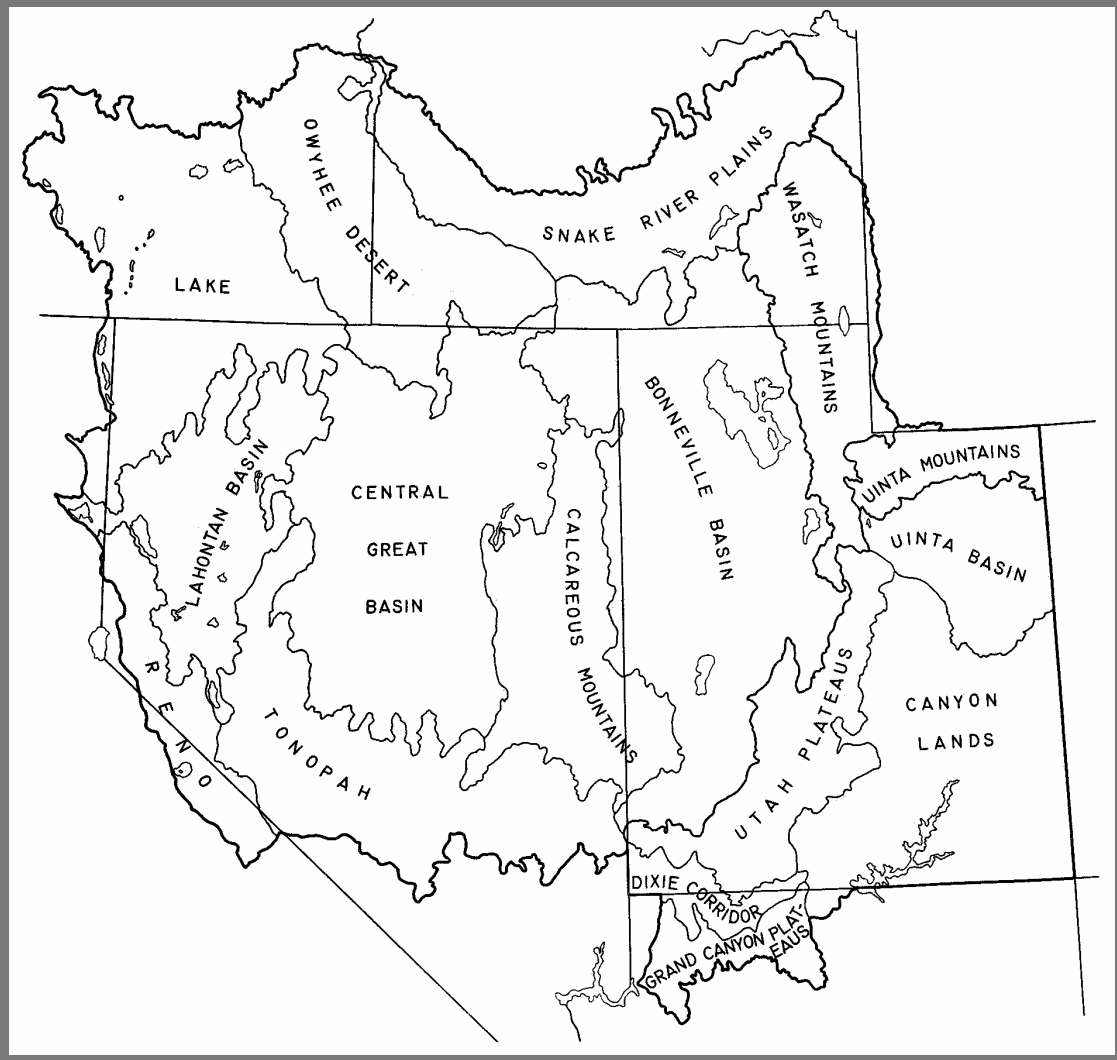
Stanford Young (UCIA), Randy Johnson and Nancy Shaw (USDA-FS)

OR

Who's Invited To Splash In The Great Basin (Gene) Pool?

Stanford Young (UCIA), Randy Johnson and Nancy Shaw (USDA-FS)

The Great Basin



Great Basin (Gene) Pools: How Many, How Big, and What's Invited?

- Philosophy: Local is better
- Practicality: How local is local?
- Politics: All (political) grass roots are local, but grass (political) heads are up in the air swaying with the wind
- BOTTOM LINE: Funding may tell us how local is local

But…

Is local still local given changed environments?

- Invasives (weeds, insects, disease)
- Fire frequency
- People (mines, road sides, etc.)
- Climate change

“Locally adapted” means different things to different species

"Local" seed is often best (example from Big Bluestem in Illinois)

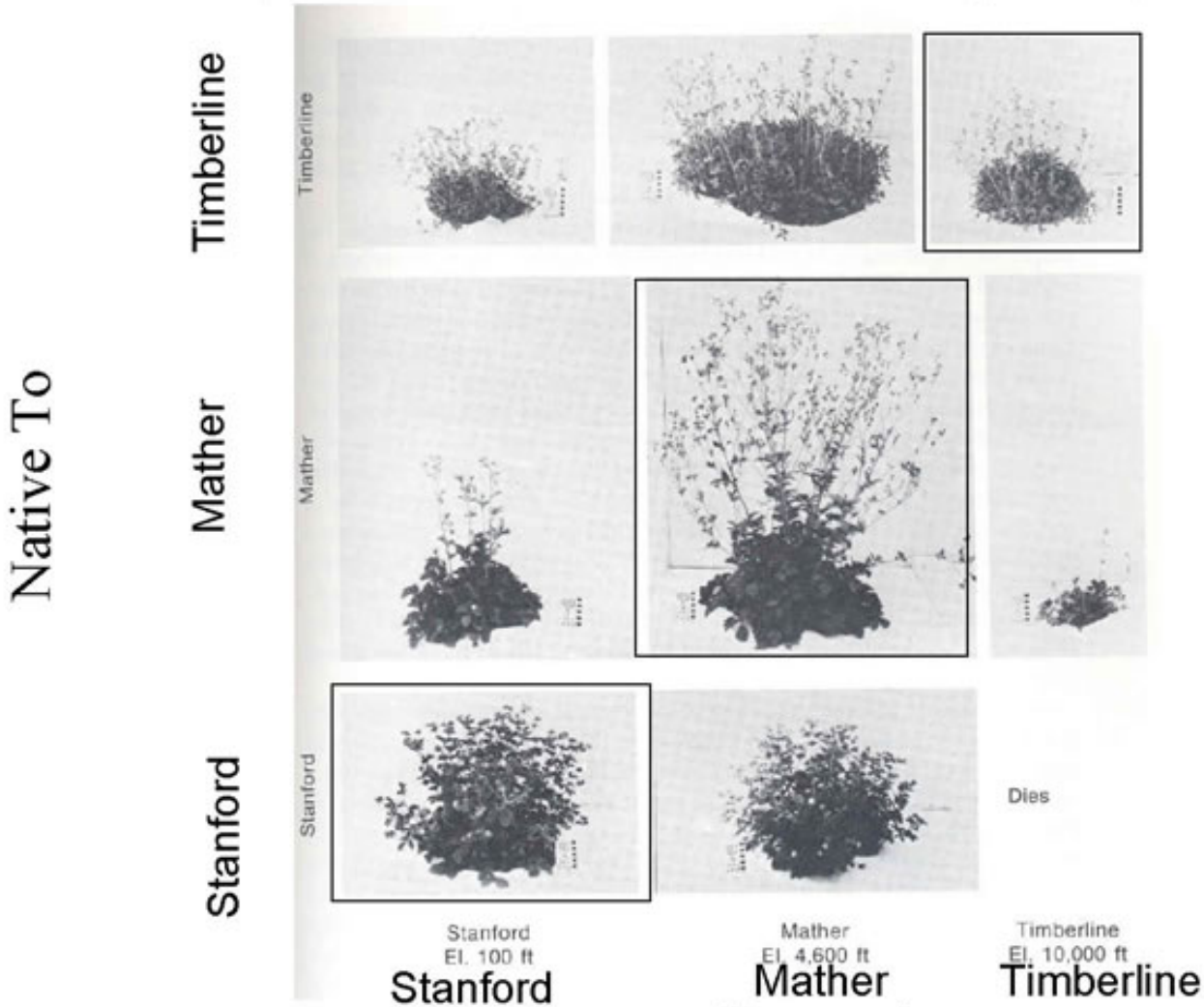
USING LOCAL SEEDS IN PRAIRIE RESTORATION

—data support the paradigm—

| Danny J Gustafson, David J Gibson, and Daniel L Nickrent |

Figure 2. Restored tallgrass prairie at Goose Lake Prairie State Natural Area, Grundy County, Illinois. The area was planted in the 1970s and photographed in September 1998. Left of the bag was established with a Nebraska cultivar of *Andropogon gerardii*, whereas an Illinois source was used to the right of the bag.

Potentilla glandulosa from three different elevations planted at three different elevations
(from Clausen, Keck and Hiesey 1940)



Effects Can Be Cryptic and Not Immediately Evident

(e.g., until unusual or extreme climate event)

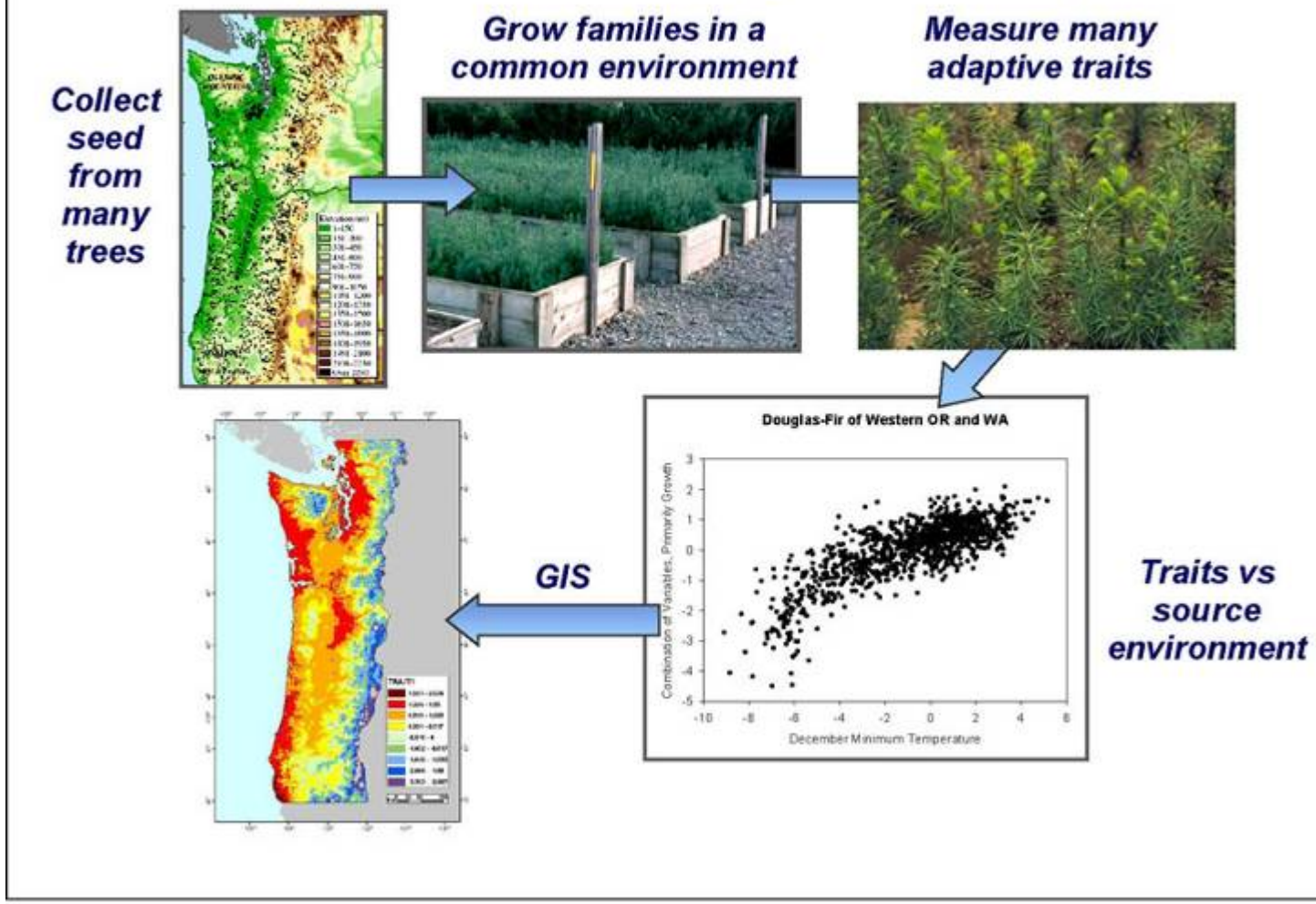
1955 cold snap in early November led to decline of off-site Douglas-fir provenances in a trial established in 1915

Grass seedings that fail during drought conditions

Genecology studies

- **Definition:** the study of intraspecific genetic variation of plants in relation to environments (Turesson 1923)

Douglas-fir common garden study



Distance needed to detect genetic differences in Northern Rockies (Rehfeldt 1994)

Species	Elev. (m)	Frost-free days	Evolutionary mode
Douglas-fir	200	18	Specialist
Lodgepole pine	220	20	Specialist
Engelmann spruce	370	33	Intermediate
Ponderosa pine	420	38	Intermediate
Western larch	450	40	Intermediate
Western redcedar	600	54	Generalist
Western white pine	none	90	Generalist

Use best available knowledge

Forest tree seed zones

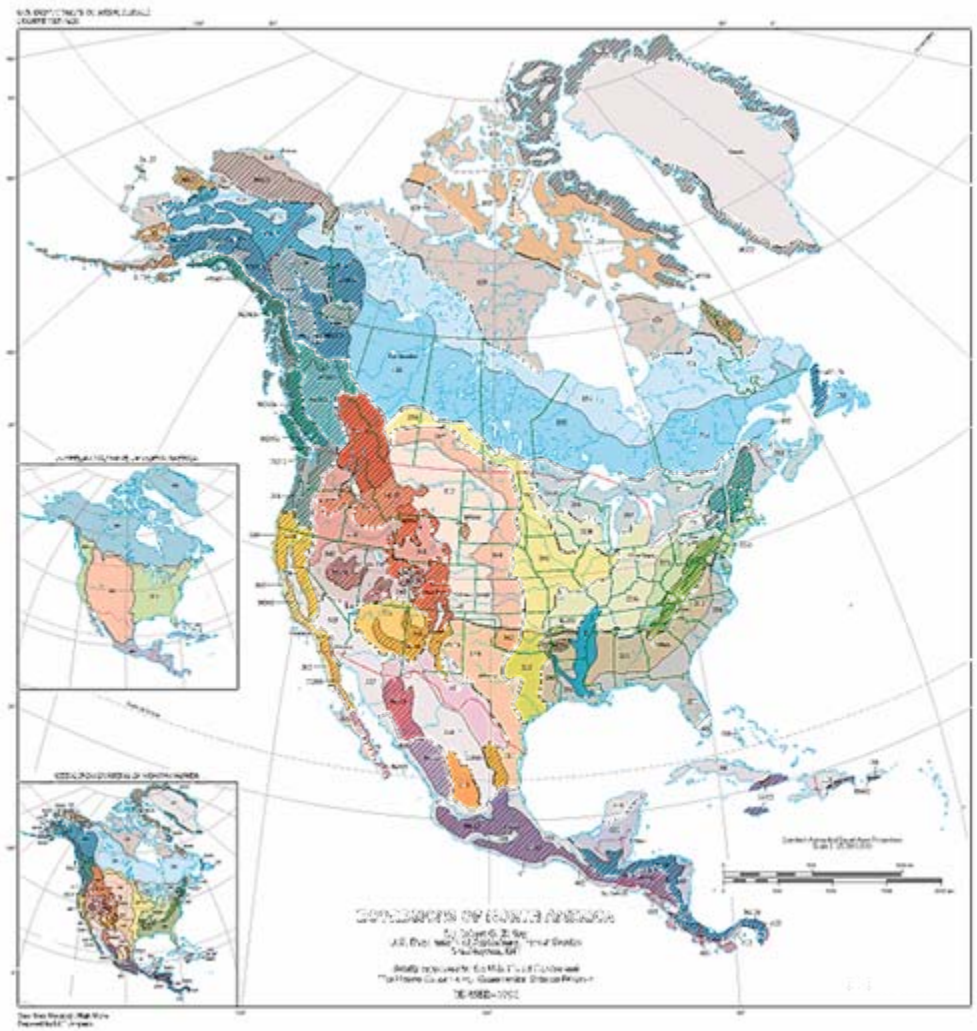
"Best Available Knowledge" does not amount to much for most Great Basin plant species.

- HOW DO WE PROCEED?

How Do We Proceed?

- A. A proposed framework: "provisional seed zones"
- B. Caveats when using these provisional seed zones
- C. Seed development process: accession pooling
- D. Accession pooling vs. seed certification agencies
- E. Are official certification tags needed for pooled lots before distribution to a seed grower?
- G. Cautions to pooling accessions

Ecoregions represent ecosystems



A. A proposed framework:

- When reestablishing ecosystems, it makes sense to use material from the same ecosystem

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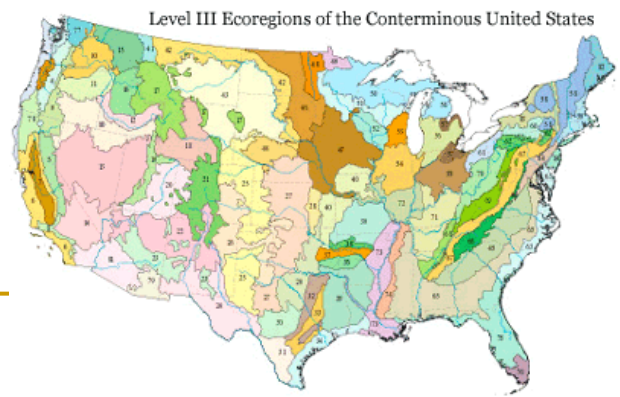
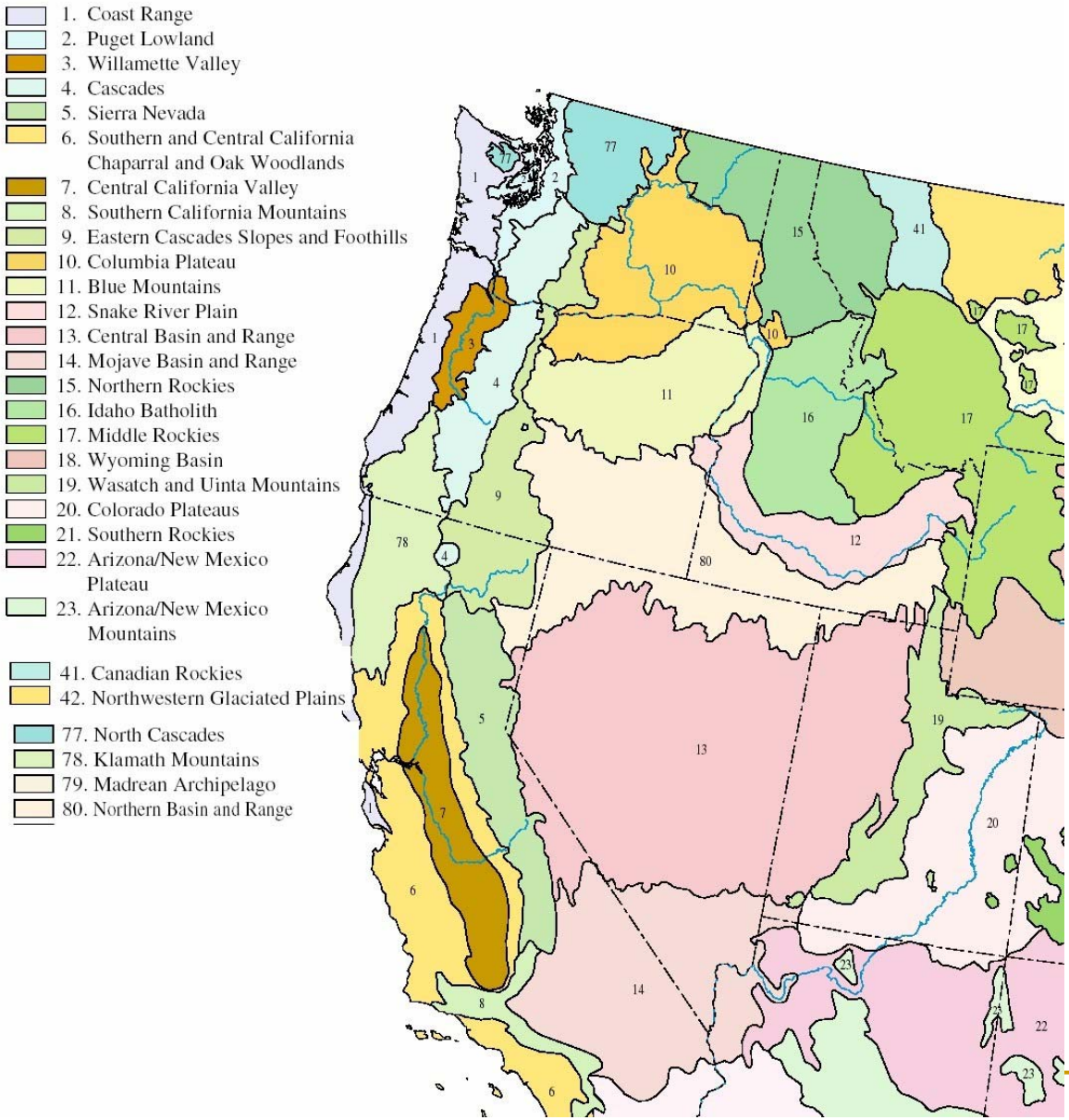
- Start with Level III Ecoregions and subdivide further where common sense dictates

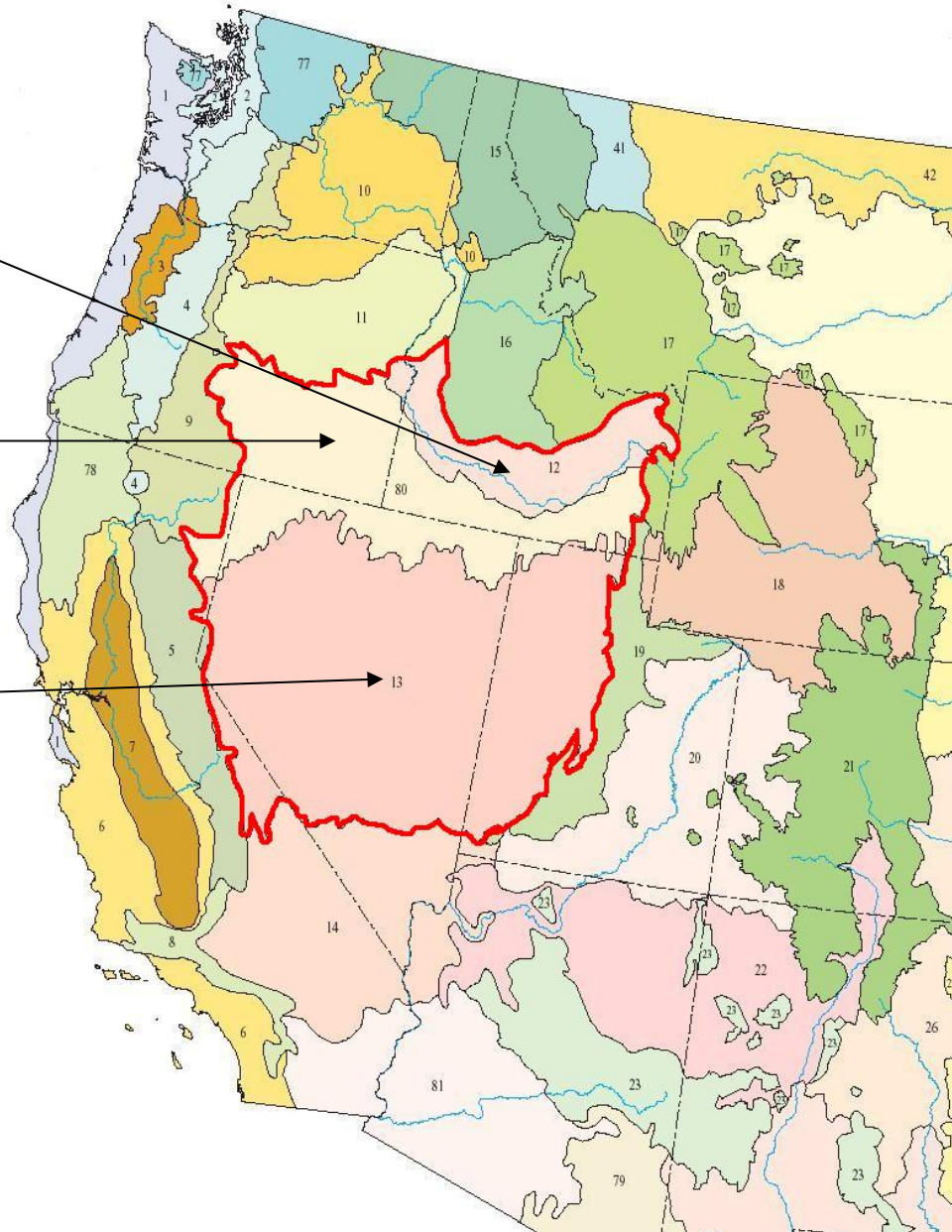




Level III Ecoregions *(Omernik)*

Proposed "Provisional Seed zones" for the Great Basin

- Snake River (12)
  - Upper
  - Lower
- Northern Basin (80)
  - Low (<4500 ft.)
  - High (>4500 ft.)
- Central Basin (13)
  - Salt flats
  - Sage
  - Sage-juniper
  - Sage-woodland



A. A proposed framework:

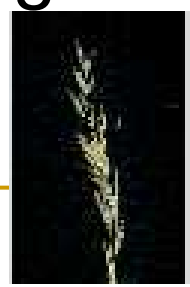
- When reestablishing ecosystems, it makes sense to use material from the same ecosystem
- Start with Level III Ecoregions and subdivide further where common sense dictates
- Accessions should adequately represent the variability in a species within each “seed zone”

B. Caveats when using these "provisional seed zones"

- Realize that seed zones differ by species; therefore, these provisional seed zones will be "wrong" for most species

(they will be either too large or too small)






B. Caveats when using these "provisional seed zones"

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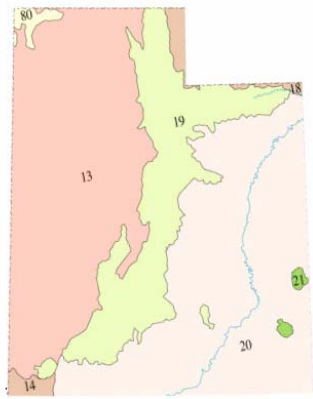
- Research is needed to construct seed movement guidelines based on real genetic data and to examine polyploid issues



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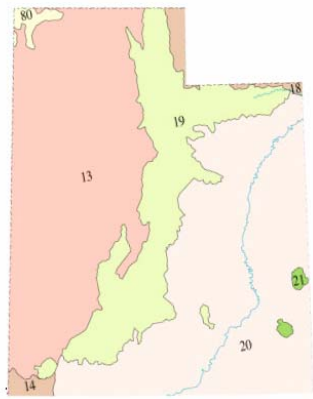
- Realize that seed zones differ by species; therefore, these suggestions will be "wrong" for most species (they will be either too large or too small)
- Research is needed to construct seed movement guidelines based on real genetic data and examine ploidy issues
- **Only use a species where the species belongs, regardless of its assigned seed zone (Duh factor)**

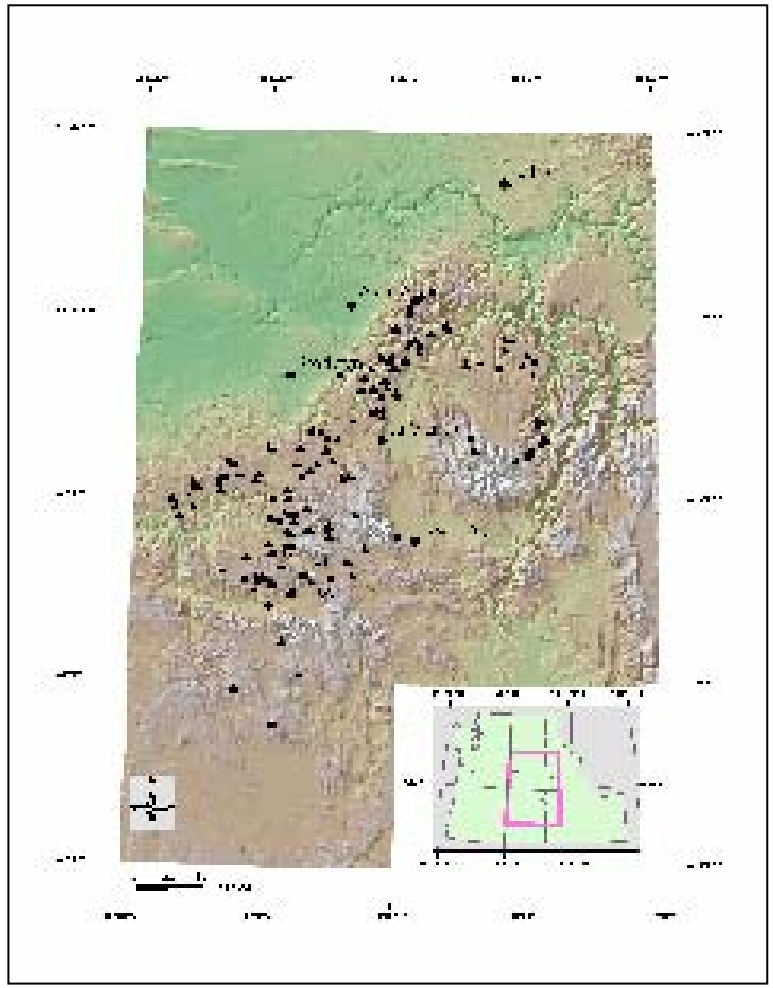
  i.e., put riparian species on riparian sites, not on dry upland sites.

Reference: NRCS Ecological Site Descriptions (ESD)



C. Seed development process

- Where possible, collect from 20 or more locations that are well distributed within a “seed zone”



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- Ensure seed is collected from many plants at each location

(>10 if possible)

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- Establish a common garden that examines all seed accessions separately (data)

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- Ensure seed is collected from many plants at each location (>10 unrelated)
- Establish a common garden that examines all seed accessions separately (data)
- Meanwhile, pool accessions with greater part of seed and provide to growers for seed increase

UTAH BOTANICAL CENTER

Fernleaf Biscuitroot

Lomatium dissectum

Medicinal Process

Formulation/Preparation

- Infusion
- Decoction
- Poultice

Characteristic Value

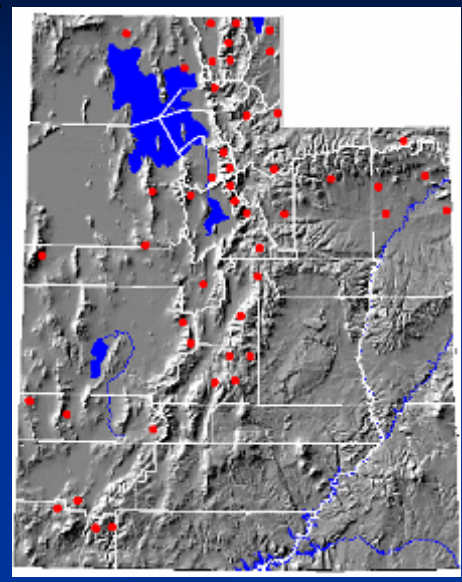
- Analgesic
- Astringent
- Antiseptic/Antibacterial
- Anti-inflammatory
- Diuretic
- Diaphoretic
- Expectorant

Plant Parts Used

- Root
- Flower
- Leaf
- Bark/Stem

Ritualistic Embellishments

- Pulverized root was burnt as ceremonial incense



Blackfoot Indians called this Big Medicine

Proposed "Provisional Seed zones" for the Great Basin

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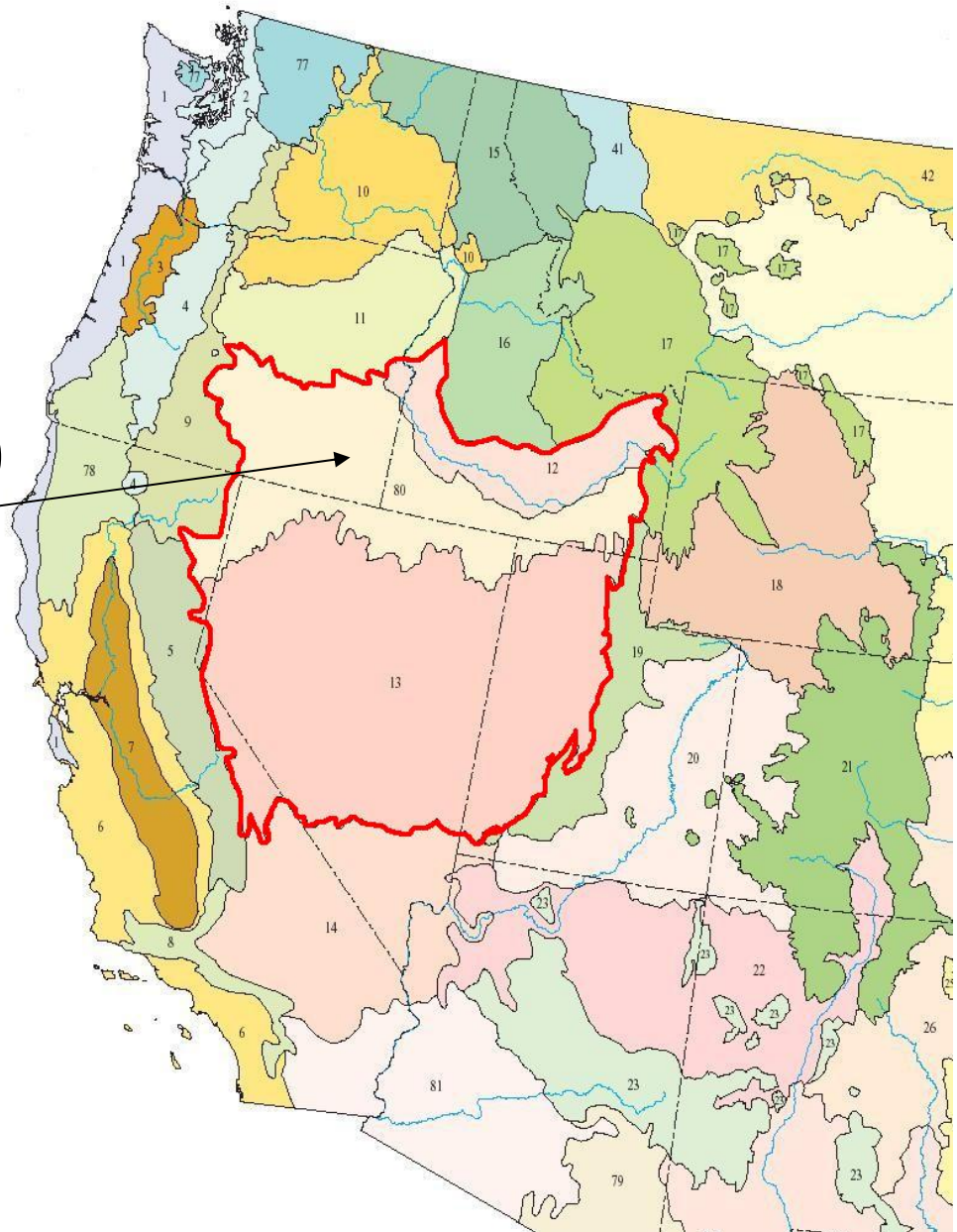

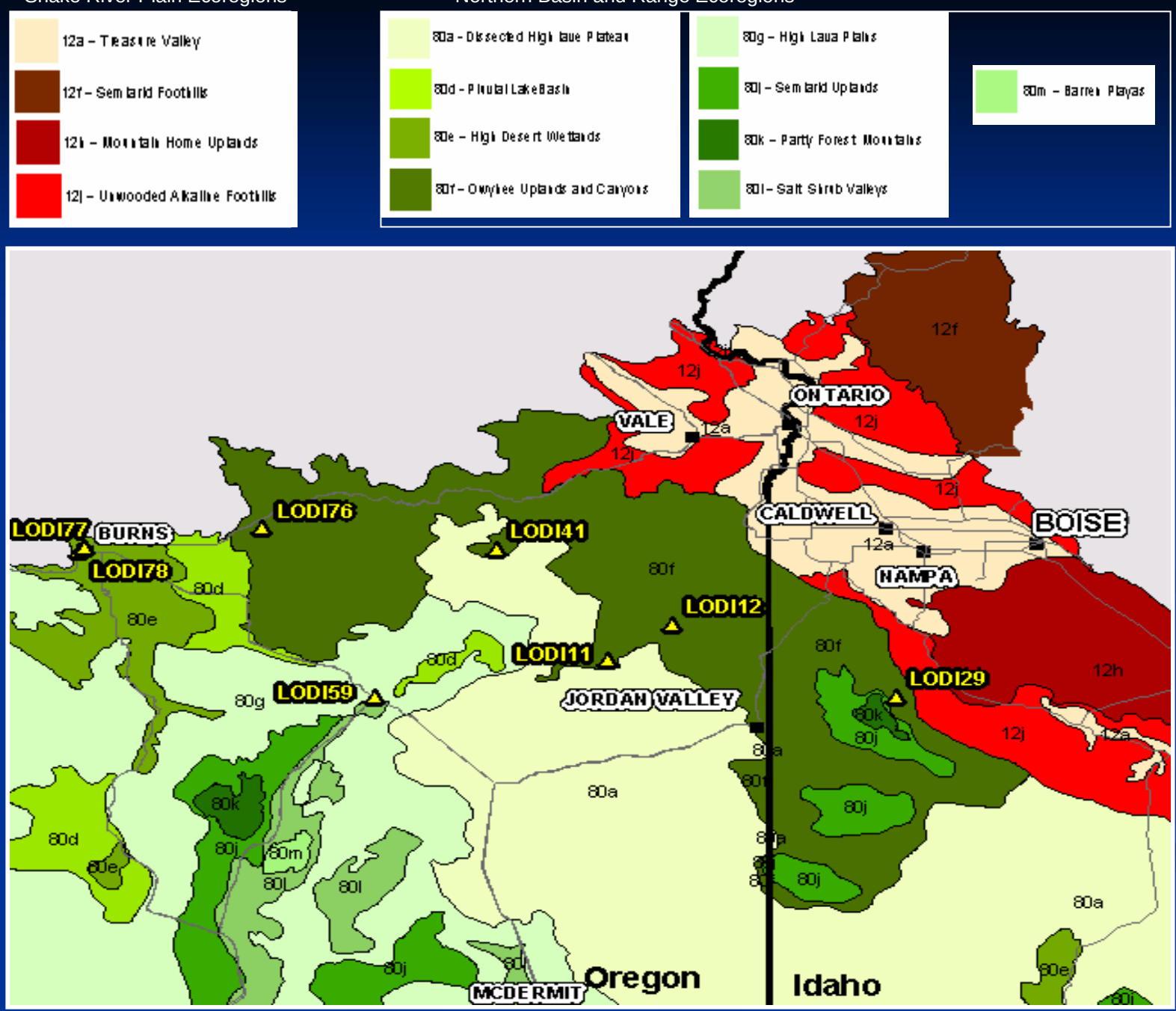
Snake River Plain Ecoregions
12a – Treasure Valley
12f – Semiarid Foothills
12h – Mountain Home Uplands
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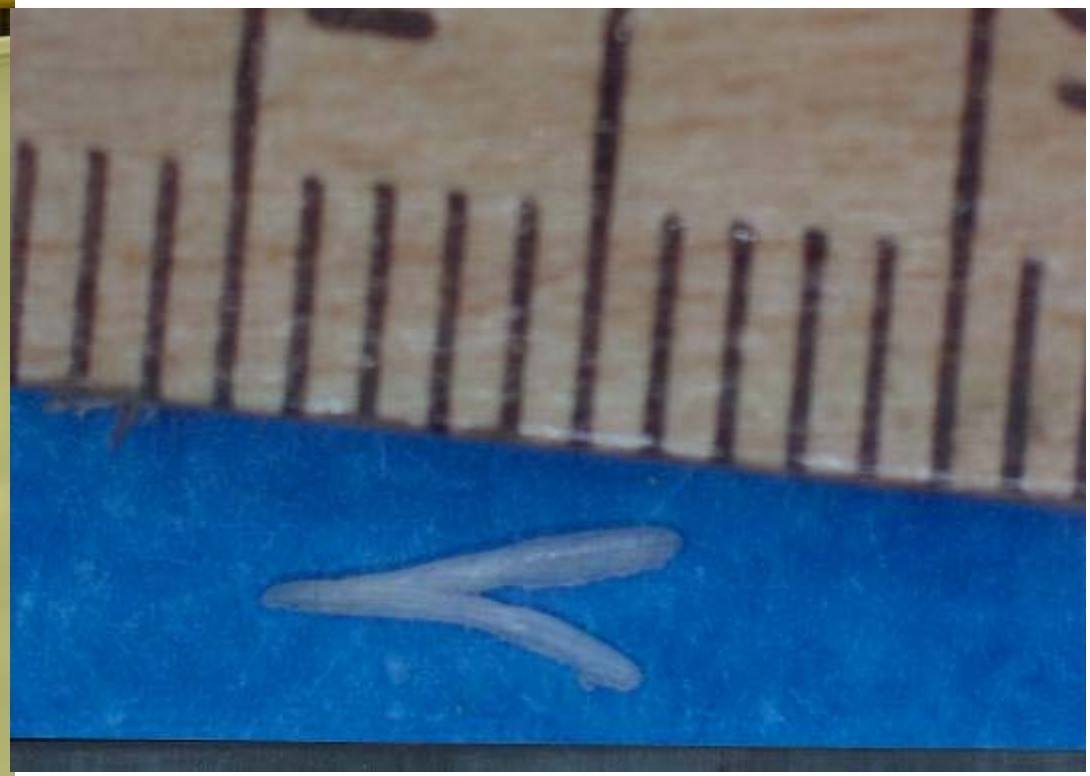
Northern Basin and Range Ecoregions
80a – Dissected High Lava Plateau
80d – Pluvial Lake Basin
80e – High Desert Wetlands
80f – Owyhee Uplands and Canyons
80g – High Lava Plains
80j – Semiarid Uplands
80k – Partly Forest Mountains
80l – Salt Shrub Valleys
80m – Barren Playas
LODI77
BURNS
LODI78
LODI76
LODI41
LODI12
LODI11
LODI59
LODI29
VALE
ONTARIO
CALDWELL
BOISE
NAMPA
JORDAN VALLEY
MCDERMIT
Oregon
Idaho


Fernleaf Biscuitroot
Lomatium dissectum
1 cm 2 3 4 5 6 7


Lom
Rep 3




(719)

LODI Pooled Accession Details

Level IV Northern Great Basin (80)

1. Low (<4,500 ft)

		Seed Availability						
Lot No.	**Location**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**Total**
LODI12	Leslie Gulch	0	4	0	77	613	0	694
LODI11	Birch Creek	0	53	0	167	316	0	536
LODI29	Silver city Road	0	0	30	0	149	???	179
LODI76	Hwy 20 MP 157	0	0	0	0	419	91	510
LODI78	Burns Seneca Hwy	0	0	0	0	117	50	167
LODI41	Crowley	0	0	105	177	5064	83	5429
LODI77	Burns	0	0	0	0	455	681	1136
LODI59	Hwy 78	0	0	0	0	323	0	323
								Total
	Summary:							
	8 sources							
	Elevation range: 2873 - 4400							

LODI Pooled Accession Details (cont.)

Lot No.	Ind Plt 2006	Blend PLS lbs	Elev. (ft)	Level 4 Ecoreg.	Ecoregion Name
LODI12		0.5	2873	80f	Owyhee Uplands and Canyons
LODI11	T	0.5	3147	80f	Owyhee Uplands and Canyons
LODI29		0.125	3912	80f	Owyhee Uplands and Canyons
LODI76	T	0.5	3600+	80f	Owyhee Uplands and Canyons
LODI78	T	0.125	4103	80e	High Desert Wetlands
LODI41	T	1	4128	80a	Dissected High Lava Plateau
LODI77	T	1	4168	80e	High Desert Wetlands
LODI59		0.25	4400	80g	High Lava Plains
	PLS lbs	4			

D. Can accession pooling be accommodated by seed certification agencies?

- YES!!

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- AOSCA PVG Standards I.B.4.SectionV. Unit of Certification: "An individual plant, clone, or stand of plants (or field or orchard) may be certified……Seed production zones and/or breeding zones may be defined as a unit of certification…"

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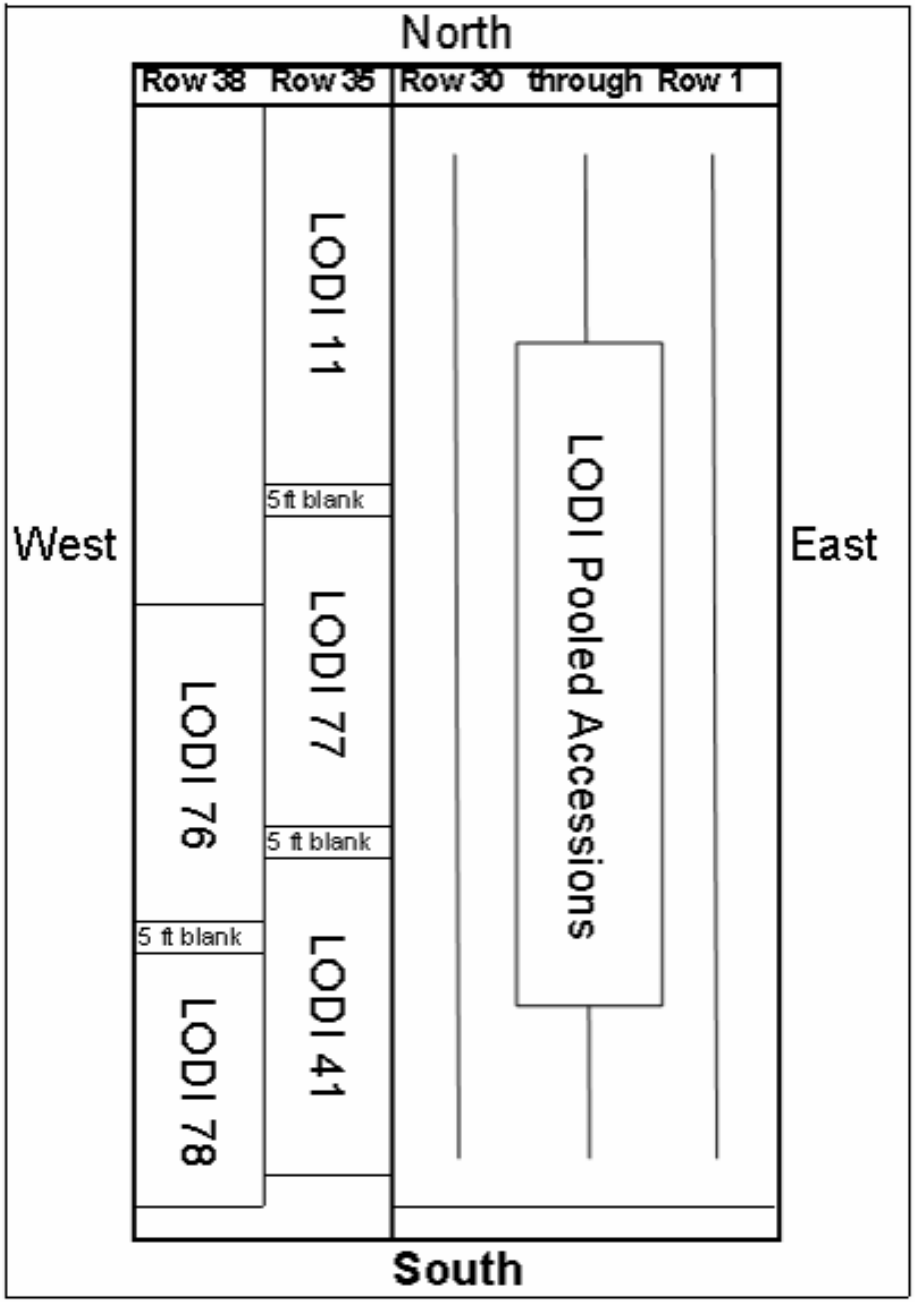
- AOSCA PVG Standards II. Land Requirements B. " Location where Selected or Source-Identified seed was collected from natural stands shall be defined by means of administrative, geographic, latitudinal, or other appropriate boundaries or descriptions judged to be significant…"

E. Does the pooled lot need to have an official certification tag before distribution to a seed grower?

- The short answer is NO
- Germplasm accessions acquired within established protocols of recognized public or private agencies are normally eligible (with appropriate data on file in lieu of the above procedures) to enter the certification process as planting stock" The AOSCA Native Plant Connection, p.7
- A "breeder" tag or informational memo to the grower and/or certification agency will suffice

Tom Day Farm, Layton, Utah


North
Row 38
Row 35
Row 30 through Row 1
LODI 11
5 ft blank
LODI 77
5 ft blank
LODI 41
LODI 76
5 ft blank
LODI 78
LODI Pooled Accessions
West
East
South

G. Cautions to pooling accessions

- Accession(s) may be from more than one genetically distinguishable populations
  - Neutral vs. adaptative variation

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  - Neutral vs. adaptative variation
  - So what?
  - **Gene pollution?**
  - **Overcome inbreeding depression?**

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  - Gene pollution
  - Overcome inbreeding depression
  - **Any worse than present seed availability?**

Table 2. Standardized Market Price for contract negotiation. 2007 GBNPSIP- UCIA project

Scientific Name	Common Name	2007 Suggested Market Price
Balsamorhiza hookeri	Hooker's balsamroot	$ 60.00
Crepis acuminata	Tapertip hawksbeard	$ 140.00
Lomatium dissectum	Giant lomatium (parsley or biscuitroot)	$ 50.00
Lomatium triternatum	Ternate lomatium	$ 50.00
Penstemon acuminatus	Sharpleaf penstemon	$ 50.00
Penstemon cyananthus	Wasatch penstemon	$ 50.00
Penstemon cyaneus	Blue Penstemon	$ 50.00
Penstemon deustus	Hot-Rock penstemon	$ 50.00
Penstemon pachyphyllus	Thickleaf penstemon	$ 50.00
Penstemon Palmerii	Palmer Penstemon	$ 25.00
Sphaeralcea munroana	Munroe globemallow	$ 60.00
Sphaeralcea grossulariifolia	Gooseberry-leaved globemallow	$ 60.00
Sphaeralcea grossulariifolia	Small Flower Globemallow	$ 60.00
Tragopogon dubius	Yellow Salsify	$ 30.00
Achnatherum thurberianum	Thurbers Needlegrass	$ 50.00
Balsamohiza hookeri	Arrowleaf Balsamroot	$ 45.00
Achillea millifolium	Western Yarrow Eagle Site	$ 15.00
Poa Secunda	Sandberg Bluegrass Mountain Home Site	$ 12.00

Proposed "Provisional Seed zones" for the Great Basin

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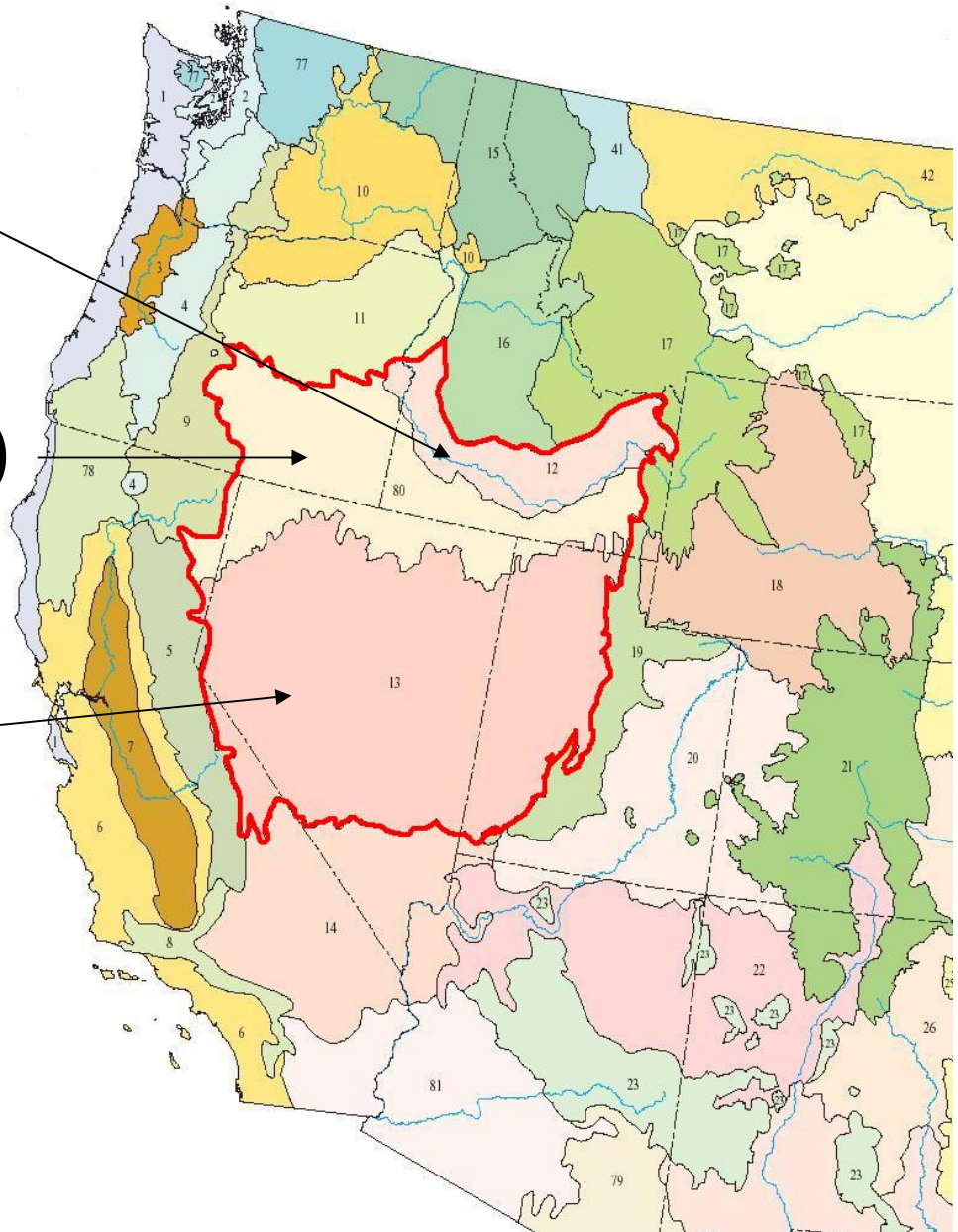

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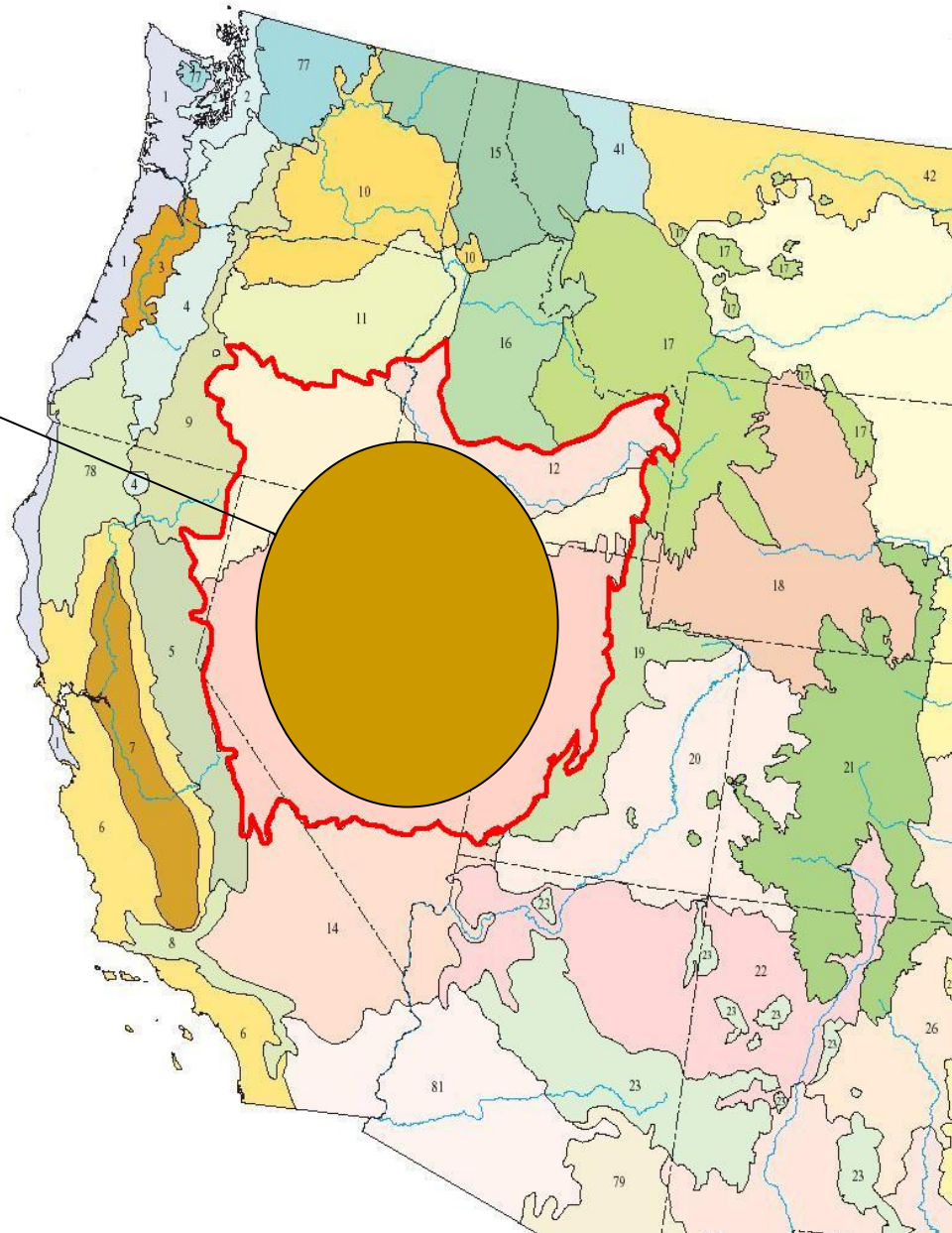
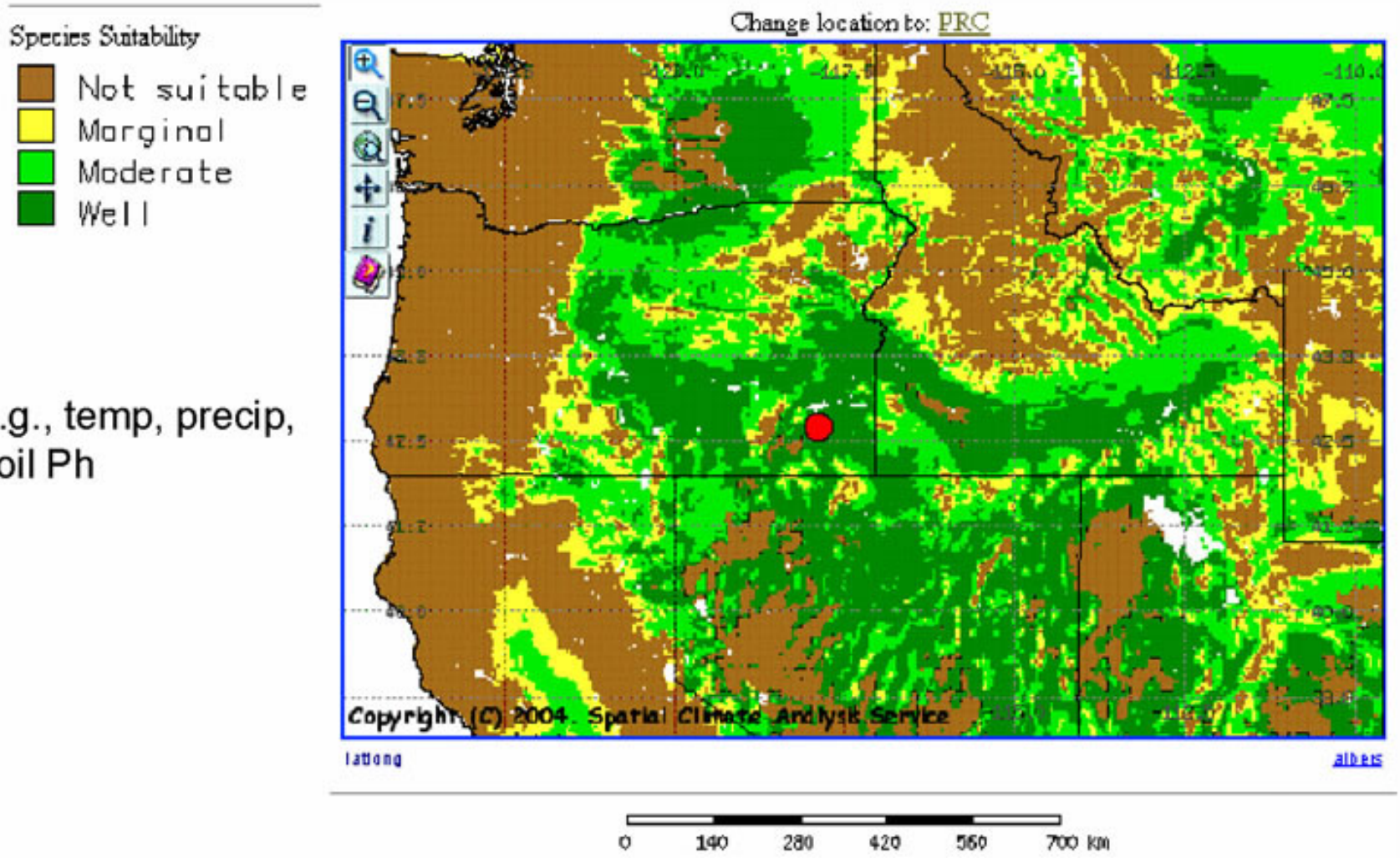


Focal-point seed zone



e.g., temp, precip, soil Ph

G. Cautions to pooling accessions

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  - "A cautionary note: avoid pooling accessions" (Dunwiddie and Delvin, Native Plants Journal Vol. 7, No. 2, 2006)

- “A series of interacting steps resulted in the use of the wrong species in a prairie restoration. Contributing factors included misidentifying species of fescue, combining seeds from nearby sites, favoring the collection of seeds from one species over another in the wild as well as in the nursery, and compounding the preferential selection of a species when increasing limited seed supplies for commercial production.”

Figure 3. Rows of drill-seeded fescue thrive in a newly planted prairie restoration project. Most of the plants in this picture proved to be *Festuca rubra* rather than the native *Festuca roemeri*.

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  - Overcome inbreeding depression
  - Worse than present seed availability situation?
- Accession(s) may be misidentified as, or contaminated by, other species
  - "A cautionary note: avoid pooling accessions" (Dunwiddie and Delvin, Native Plants Journal Vol. 7, No. 2, 2006
  - Avenues to avoid or live with this pitfall
    - Individual accession growouts before pooling
    - Individual accession AFLP marker check before pooling
    - Trust your collectors
    - Accept tolerance for off-types

Species misidentification or off-types?

UTAH Certified Seed

How Do We Proceed?

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What are the types of "repair" available for disturbed sites in the GB?

- **REVEGETATION**
- **RECLAMATION**
- **REHABILITATION**
- **RESTORATION**

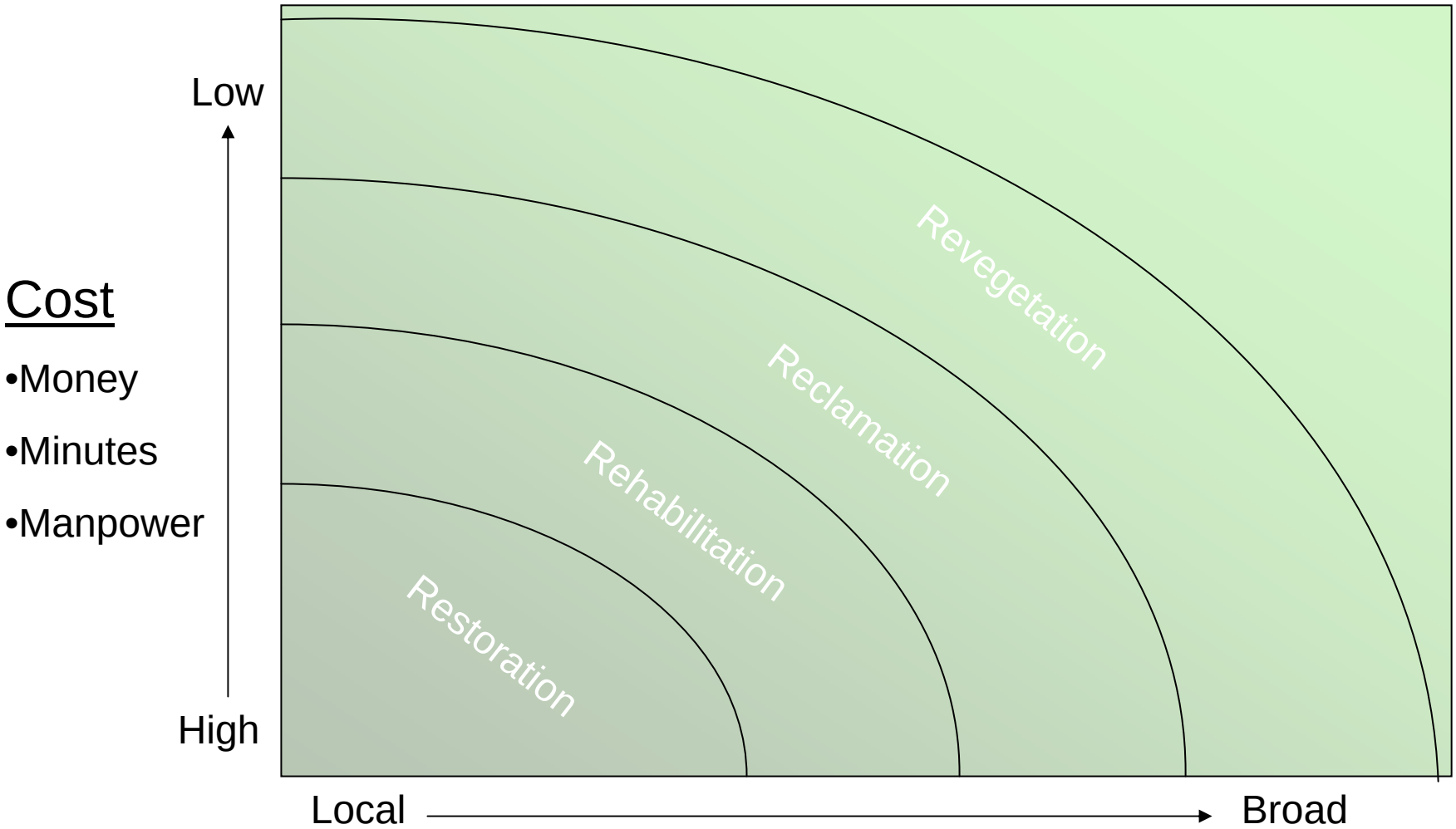
- **Can the seed industry accommodate any and all of these choices?**

ASTA Position Statement on "The Use of Local Native Seed"

- "The purpose of this Position Statement is to set a framework within which the land manager can make consistent decisions that the seed supplier can predict. Since the seed supplier must plan their crops one or more years in advance, a consistent and predictable use of materials will help insure that the correct species are produced in the quantities needed to service the land repair business."

ASTA Guidelines:

- Identify a flexible set of goals and objectives for the land repair project
- Carefully assess those goals and objectives to insure they are ecologically and economically achievable
- Select plant materials that are consistent with the goals and objectives of the project
- Select plant materials whose ecological and economic success to the project can be demonstrated by sound science
- Select plant materials that are either currently available in the marketplace or can be acquired within a reasonable period of time
- Change the goals and objectives of the project when they are difficult to attain because of ecological or economic constraints
- Publish reports of project successes and failures and encourage research institutions to improve the techniques used for land repair

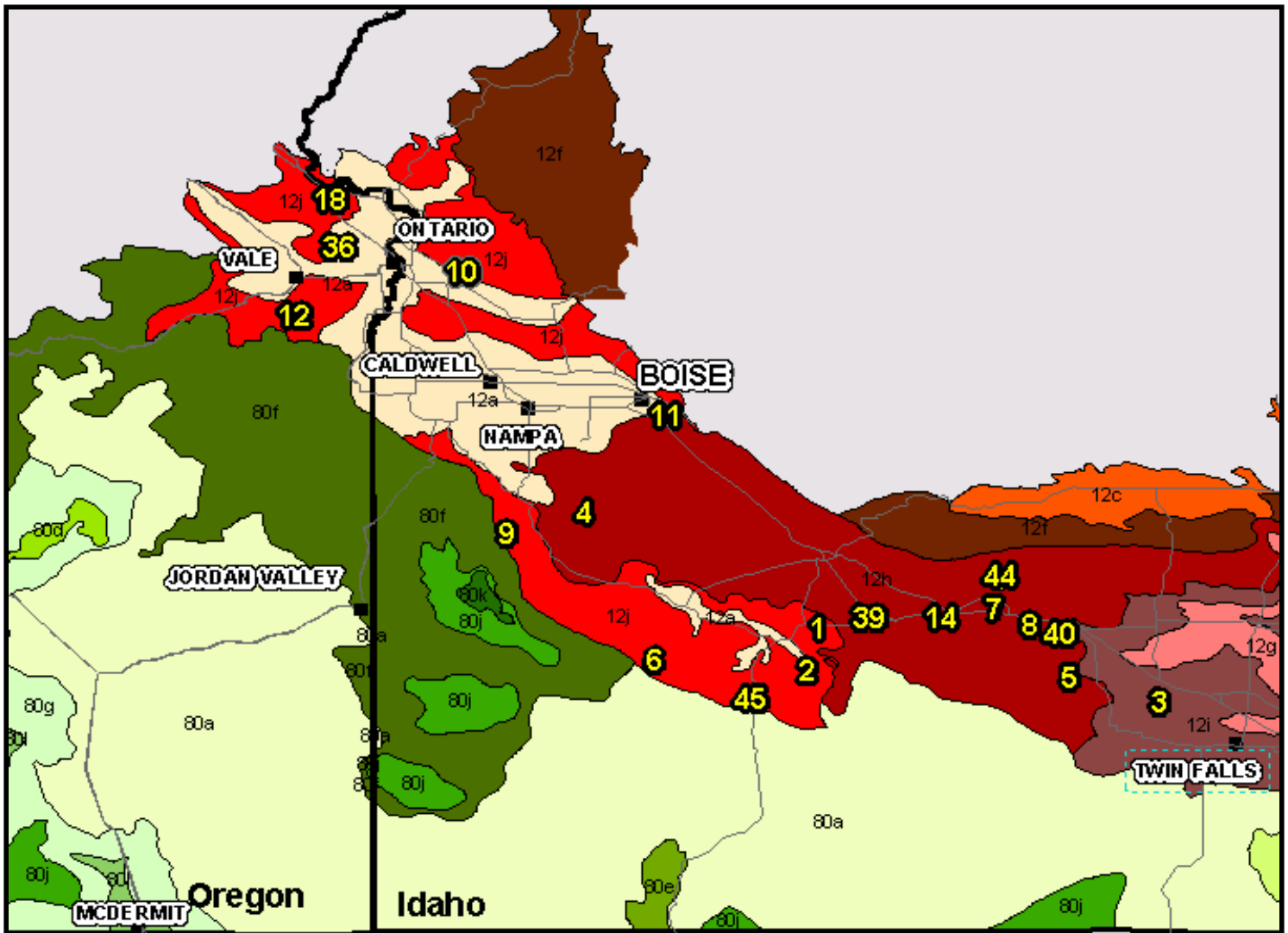

Low
Cost
•Money
•Minutes
•Manpower
High
Revegetation
Reclamation
Rehabilitation
Restoration
Local
Broad
Plant Materials
•Adaptability
•Applicability
•Availability

Snake River Plain Ecoregions

- 12a – Treasure Valley
- 12b – Lava fields
- 12c – Camas Prairie
- 12f – Semiarid Foothills
- 12g – Eastern Snake River Basalt Plains
- 12h – Mountain Home Uplands
- 12i – Magic Valley
- 12j – Unwooded Alkaline foothills

Northern Basin and Range Ecoregions

- 80a – Dissected High Lava Plateau
- 80b – Semiarid Hills and Low Mountains
- 80c – High Elevation Forests and Shrublands
- 80e – High Desert Wetlands
- 80f – Owyhee Uplands and Canyons
- 80i – Sagebrush Steppe Valleys
- 80j – Semiarid Uplands
- 80k – Partly Forested Mountains



Best available knowledge – focal-point seed zones

- Compare planting size environment with those of surrounding area
  - Seedware (Ontario Canada)
    - http://g4.glfc.cfs.nrcan.gc.ca/seedwhere.pl
  - by OSU's PRISM Group
    - http://mistral.oce.orst.edu/forages/